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64-2890

NPIC/D-60-64
2 APR 1964

25X1A [redacted]

MEMORANDUM FOR: Deputy Director of Central Intelligence

VIA : Assistant Deputy Director (Intelligence) for Management

Executive Director - Comptroller

SUBJECT : Research and Development Project Approval Request for a Virtual Image Viewer

REFERENCE : DDCI Memo ER 63-88121, dated 23 December 1963: Approval of Research and Development Activities

In compliance with paragraph 4.b. of the reference, it is requested that the procurement of a Virtual Image Viewer outlined in Annex "A" be approved.

[redacted] 25X1A

for ARTHUR C. LUNDAHL
Director
National Photographic Interpretation Center

CONCURRENCES:

25X1A [redacted]

Assistant Deputy Director (Intelligence) for Management — Date

25X1A NA [redacted]

Executive Director - Comptroller — Date

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SUBJECT: Research and Development Project Approval Request for a Virtual Image Viewer

APPROVED:

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for (signed [redacted]

Lieutenant General, USA
Deputy Director of Central Intelligence

23 APR 1964
Date

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NPIC/P&DS/DB: [redacted] (31 March 1964)

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ANNEX A

Research and Development
Project Approval Request

I. Identification

The National Photographic Interpretation Center, Plans and Development Staff intends to undertake the development of a Virtual Image Viewer for the amount estimated by a proposal from [redacted] 25X1A
25X1A [redacted] of [redacted] This project has progressed through the feasibility study, experimentation and planning for an experimental engineering model during the past twelve months. This development was programmed for fiscal year 1964 at the [redacted] level in the 25X1A
NPIC Financial Plan under Viewers.

II. Objectives

The proposed instrument will have the inherent capabilities of a high quality microscope plus the viewing freedom of the conventional rear projection screening viewer. Operational models are to be designed for use in the manner of the conventional screening viewer. The Virtual Image Viewer is expected to provide at least a 100% gain in image quality over existing viewers and to equal the scientific microscope now being brought into limited use as an interpretation tool.

III. Background

This development stems from the basic assumption that the photo interpreter must have viewing equipment that will comfortably present to his eye the maximum amount of information recorded on a photographic medium. The Intelligence Community is on the threshold of receiving materials of low contrast and high resolution (2:1 or lower contrast and 200 l/mm). The only exploitation device that can begin to extract up to 95% of the information content of the "original negative" alone is the high quality laboratory microscope.

The feasibility study proved that, in virtual image viewing, the concept of crossed diffraction gratings generating multiple exit pupils was a method of circumventing limitations of low magnification imposed by geometric optical laws. The theoretical maximum in such optics is 5X magnification.

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It is obvious that within the next generation of viewers, the limits of exploiting photographic images with rear projection viewers will have been reached. This is based on the presumption that the best possible manufacturer is under contract and is designing the state-of-the-art of components into the latest rear projection viewers.

The logical alternative is to consider a system of viewing which bypasses the most deteriorating element of the rear projection system -- the screen -- which forms the image of the object (in this case, the photographic image itself) directly on the retina of the human eye.

It has been suggested that such a system could be based upon the principles of viewing in the microscope. The laws of physical optics, however, would limit the view to micro-areas when achieving the high magnification desired.

IV. Technical Specifications

Light Source. The light source will have a narrow spectral band width, preferably in the 450-550mμ region.

Intensity of Light. This should be of such intensity (variable) so that a density difference of 0.05 (desirable density difference 0.02) can be visually discriminated over a density range of 0 to 2.5.

Condenser System. The condenser system should be individually designed for each projection lens (magnification) or by manipulating changeable elements to achieve the same high quality of illumination as would be accomplished by individual condenser systems.

Film Platen. The film platen shall be of high quality flats, free of imperfections and particularly striations.

Film Temperature. The temperature shall not exceed ambient (75°F) by more than 20°F. Forced air cooling will be provided if necessary.

Projection Lenses. The lenses shall be of the highest quality available. If possible, they initially should be selected commercially. It is recognized that designed lenses would take advantage

of the narrow band width of illumination and have the appropriate conjugate foci for the instrument. It may be necessary also to change the lens element spacing if it would add to the efficiency of the lens by accommodating the conjugate foci of the instrument. Only after adequate research and evaluation of off-the-shelf projection lenses will the technical monitor be consulted before a go ahead for a lens design is permitted.

Field Lens. The field lens will be designed and manufactured to meet the requirements of the overall optical system.

Size of the field viewed will not be less than 8 x 10" - the lateral distance (width) will be the 10".

Chassis. A sturdy structure will be designed and constructed to mount the various elements and components of the system. This mounting will be of the quality providing the precision alignment necessary for maximum resolution rendition.

Mechanics and Electronics. Only those mechanical and electrical components that are absolutely necessary to insure smooth and efficient operation will be used. Of course, quality items will be used throughout.

Diffraction Gratings.

The crossed diffraction gratings will be designed and manufactured to insure even illumination over the entire field.

The frequency of rulings will be computed to insure adequate exit pupils to support a 50X maximum, the magnification goal for the experimental engineering model.

Format Requirements. A minimum of 2¼" square at the lowest magnification, 12X, will fill the largest dimension of the field lens.

Resolution. The ultimate goal for the viewer is to achieve 7 l/mm optical resolution with 200 l/mm low contrast material (2:1) in the film plane at the highest, 50X, magnification. The acceptable minimum will be 200 l/mm high contrast (100:1). Seven l/mm should be available to the viewer at all lower magnifications also. The Modulation Transfer Function of the finished system will be determined.

V. Contractor and Financial Arrangements

[redacted] will design and manufacture the special optics and [redacted] will design, develop and manufacture the special diffraction gratings. The concept for this viewer is proprietary with [redacted]. This Contractor, therefore, is of necessity a sole source selection. The contract is expected to have a maximum duration of 16 months and a goal of 12 months depending mostly on the timely development of the diffraction gratings to achieve the goal. The [redacted] cost of the project is [redacted] more than programmed, however, funds are available in the approved budget to cover this increase.

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VI. Coordination

An explanation of this project was presented to the reconnaissance community at the NPIC Joint Procurement Meeting in August 1963 and was approved by the NPIC Technical Development Committee on 5 March 1964. The Procurement Division, Office of Logistics has been notified of this project and preliminary steps toward contract negotiation have been taken.

VII. Security

This project is to be classified [redacted] Confidential because of association with the sponsor. Plant inspections and clearances for the participating contractor personnel have been instituted.

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